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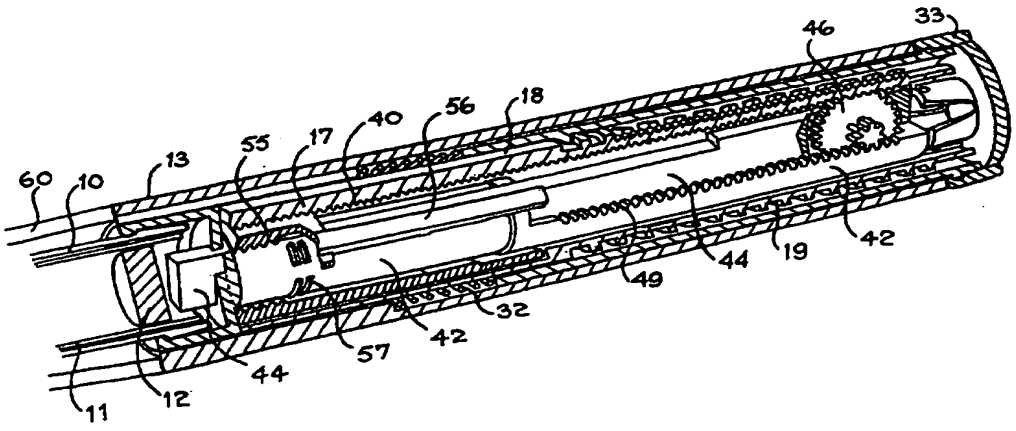
(54) Title: INCREMENTING MECHANISM IN PARTICULAR FOR USE WITH A MEMBRAL SYRINGE



(57) Abstract

A mechanism for accurate dispensing of pre-set quantities of medicament from a syringe has a plunger (17) rotatable within a housing (13), which plunger (17) has a cam surface (19) engaged by a fixed follower (22) such that rotation of the plunger (17) moves the plunger away from the synringe. Internally within the plunger there is a number of parallel racks (40) each of which in turn comes into engagement with a first toothed wheel (47) on rotation of the plunger. The first toothed wheel (47) is connected to a second toothed wheel (48) which runs on a fixed rack (49) extending within the plunger parallel to the axis thereof. The first toothed wheel (47) is coupled to a thrust rod (44) for the piston (12) of the syringe. After pre-setting a required dose by rotation of the plunger (17), the plunger is then pushed towards the synringe, so rotating the first and second toothed wheels (47 and 48). This drives the thrust rod (44) into the syringe but by appropriate selection of the toothed wheel diameters and the tooth pitch thereof, an advantageous velocity ratio between the plunger and thrust rod movements may be obtained.

Figures 6A and 6B show the operation of a zero sleeve, in two different positions;

Figures 7A and 7B are respectively a cross-section through and a cut-away isometric view through the central part of the plunger and the co-operating part of the zero sleeve;

Figure 8 is an enlarged view of part of the plunger and the cam follower engageable therewith;

Figure 9 shows the operating button separated from the plunger;

Figure 10 shows the plunger in conjunction with a dose-limiting nut;

Figure 11 is a cross-section through the forward end of the plunger and the nut taken on line XI-XI marked on Figure 1; and

Figure 12 is an external view of a pen-like self-injection device incorporating the incrementing mechanism of Figures 1 to 11.

In the following description, the term "forward" refers to the direction of the needle-end of the syringe, and to the left in Figures 1 and 2; and the term "backward" refers to the direction away from the syringe, and so to the right in Figures 1 and 2.

The incrementing mechanism shown in the drawings is configured for use with a syringe including a housing 10 containing a cartridge 11 of a medicament, the cartridge having a dispensing piston 12 which, when moved axially along the cartridge 11, dispenses medicament therefrom, through a needle (not shown) at the forward end of the syringe housing. Such an arrangement is entirely conventional and forms no part of the present invention; it will not therefore be described further here.

The mechanism has a hollow body 13 in the forward end of which is provided a stop member 14 including an inwardly-directed rib 15 by means of which the body 13

may be mounted on the syringe housing 10, the rib 15 engaging in an external groove around that housing 10. Both rotatably and axially slidably mounted within the body 13 is an operating plunger 17 having formed along a forward portion 18 thereof columns of dose-indicating markings, and along a rearward portion thereof a cam surface 19 (see particularly Figures 3 and 8). A window 20 is formed in the body 13 to permit viewing of the index marks on the forward portion 18 of the plunger, an enlarging lens 21 being fitted in that window 20. The lens 21 is a part of a cam follower 22, which may resiliently engage with cams and ratchet teeth 24 formed on the cam surface 19. When so engaged, rotation of the plunger 17 in the appropriate sense will cause the plunger to move backward (rightwards in Figures 1 and 2) as the follower threads along the cams on the cam surface 19, so successively displaying the index marks through the window 20. Subsequently, the plunger may be thrust forward until its forward end engages radial face 23 of the stop member 14, the cam follower 22 riding over the ratchet teeth 24 of the cam surface 19 during this action. To allow this to occur, the ratchet teeth 24 are ramped (Figure 8), which teeth are arranged in five aligned columns, so that the plunger may be thrust forward only when follower 22 is aligned with one of the columns of teeth 24.

Slidably mounted within the housing 13, in the rearward part thereof, is a zero sleeve 25 (Figures 6A and 6B), the plunger 17 being rotatably received within the sleeve 25. A slot 26 is formed axially along the sleeve 25, arm 27 connecting lens 21 to the cam follower 22 extending along that slot and restraining the sleeve against rotation. The forward end of the sleeve is provided with a shutter blade 28 which obscures (Figure 6A) or opens (Figure 6B) the window 20

through the body 13, the index marks on portion 18 not being visible when the sleeve is in the position of Figure 6A.

At the forward end of the sleeve 25, there is an inwardly-directed catch 29 (Figures 7A and 7B), the sleeve having axial slits to each side of the catch to allow outward springing thereof. An annular rib 30 (Figures 3, 7A and 7B) extends around the plunger 17 between the forward portion 18 and the cam surface 19, the rib 30 having a notch 31 through which the catch may pass. A helical compression spring 32 acts between the forward end of sleeve 25 and an internal shoulder in the body 13, urging the sleeve to the right

The sleeve 25 may be moved to the left relative to the plunger 17 by springing the catch 29 over the rib 30; the catch will then hold the sleeve in the position illustrated in Figure 6A and 7B, with the shutter blade 28 closing the window 20. Rotation of the sleeve 25 relative to the plunger 17 will bring the catch 29 into alignment with the notch 31, whereby the sleeve may move to the position shown in Figure 6B under the action of spring 32.

An operating button 33 is engaged with the rearward end of the sleeve 25 by means of a rotatable coupling 34. The button has two internal lugs 35 each of which has a projection 36, the projections 36 being slidingly engaged in splines 37 formed at the rearward end of the plunger 17. The plunger will normally be driven by rotation of the button 33, but should the torque applied to the button 33 exceed some predetermined value, then the button may rotate with respect to the plunger by the projections 36 springing inwardly to ride over the splines 37.

From the position of Figures 1 and 6A, rotation of the button 33 will align catch 29 with notch 31, whereupon the button and sleeve 25 will move under the

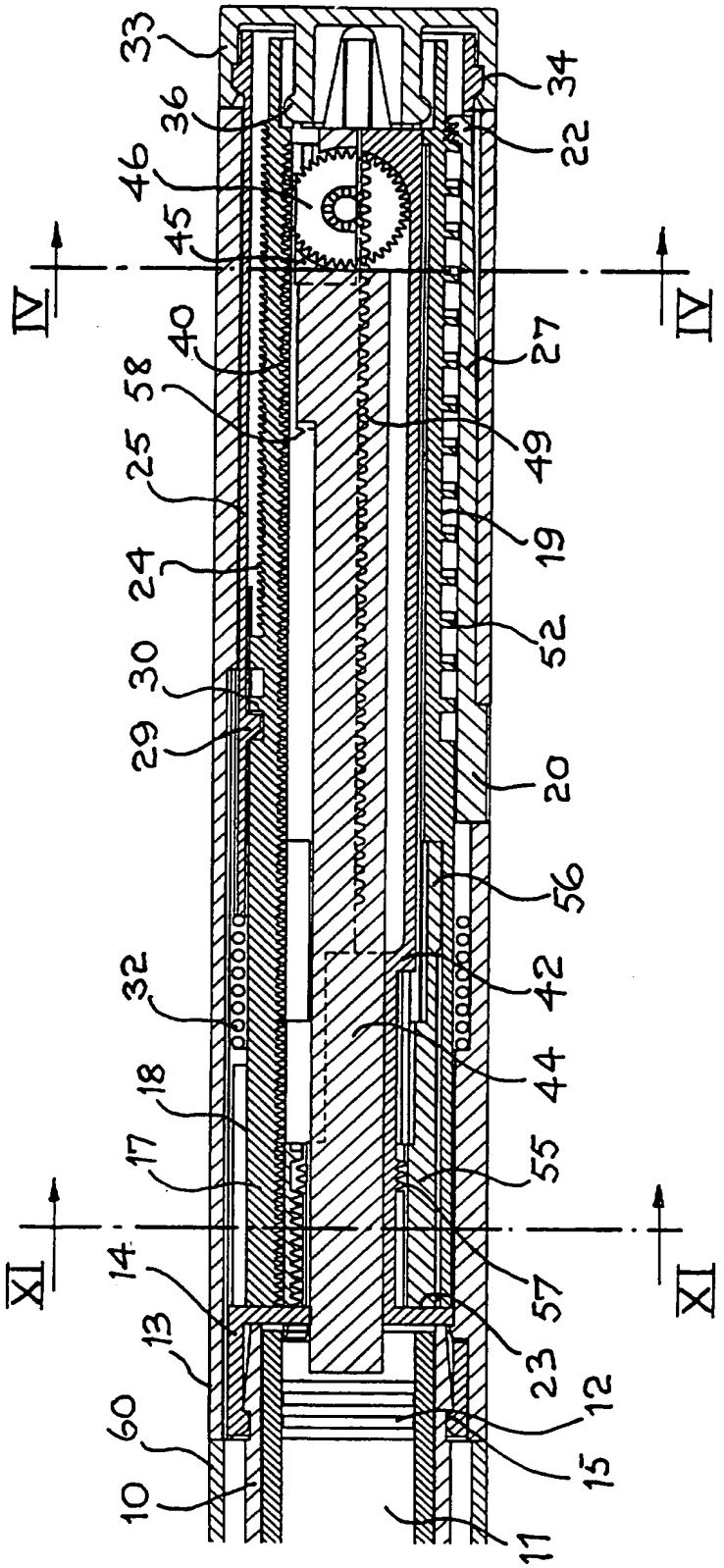

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FIG 1

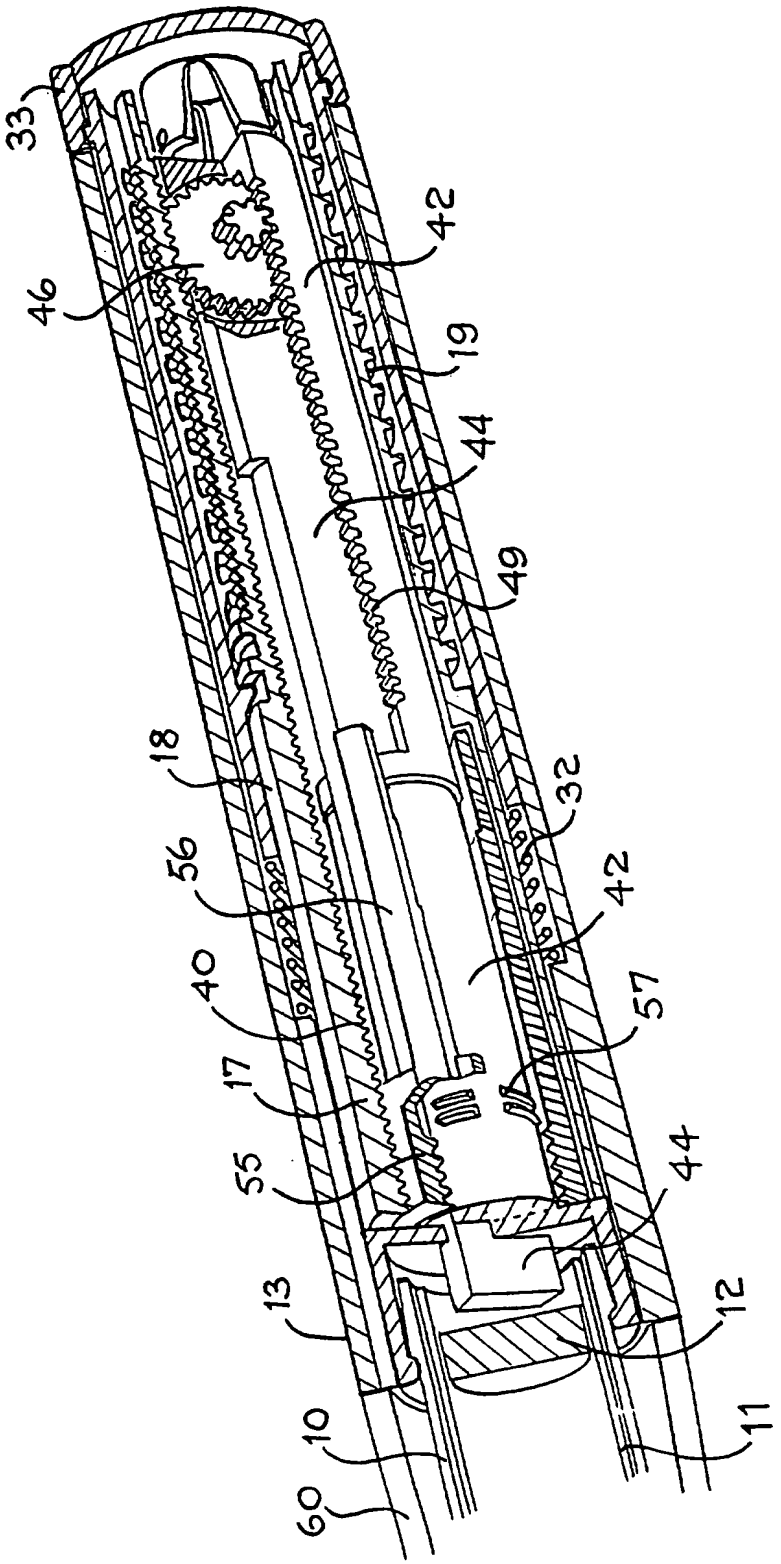


FIG 2

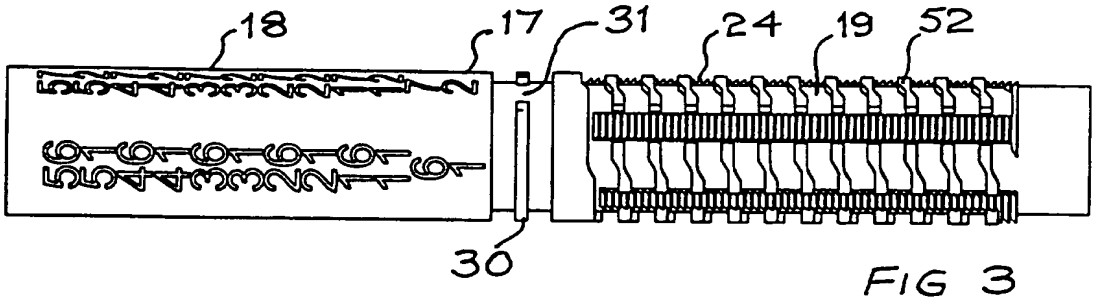


FIG 3

FIG 4A

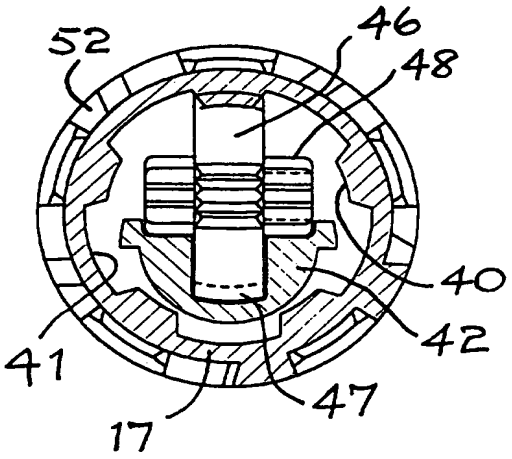
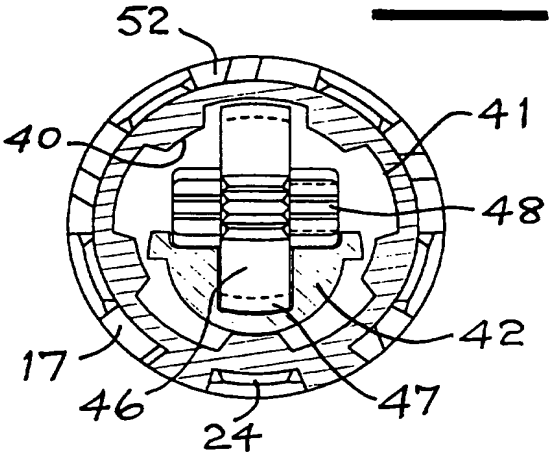


FIG 4B



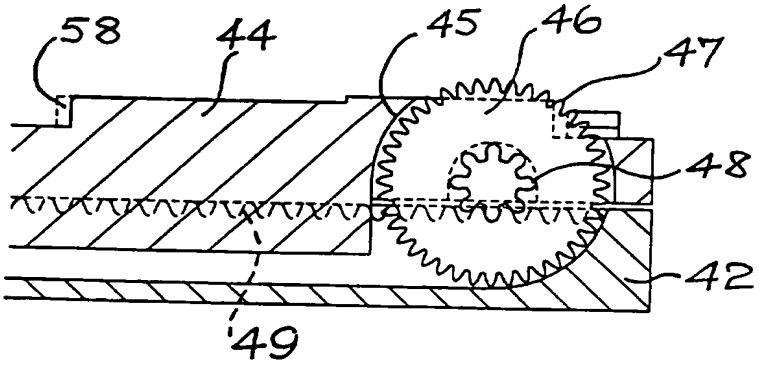


FIG 5

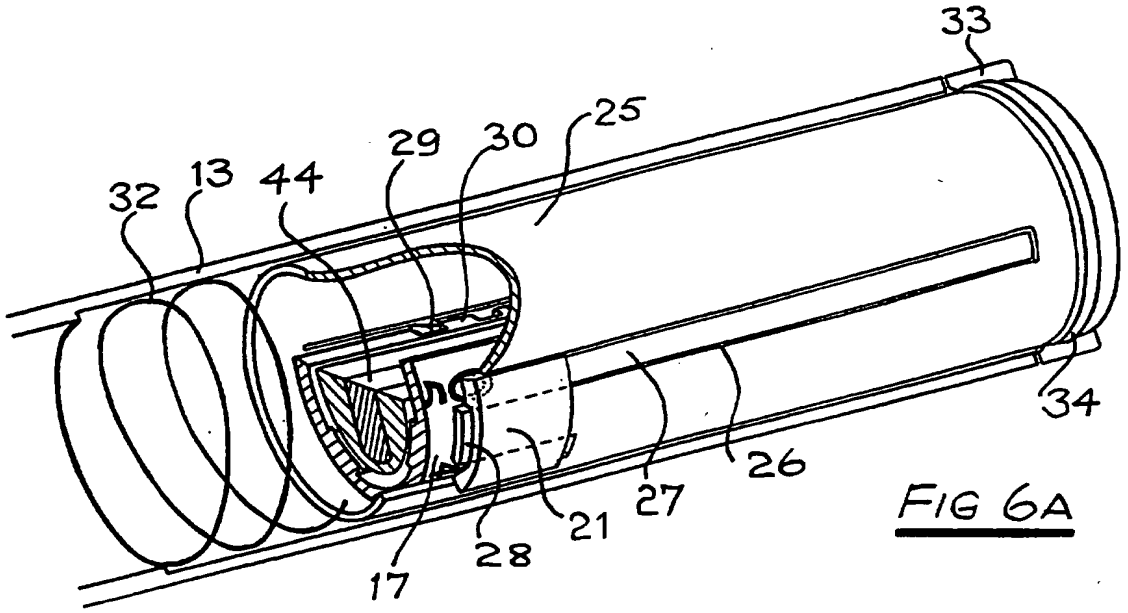

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FIG 6A

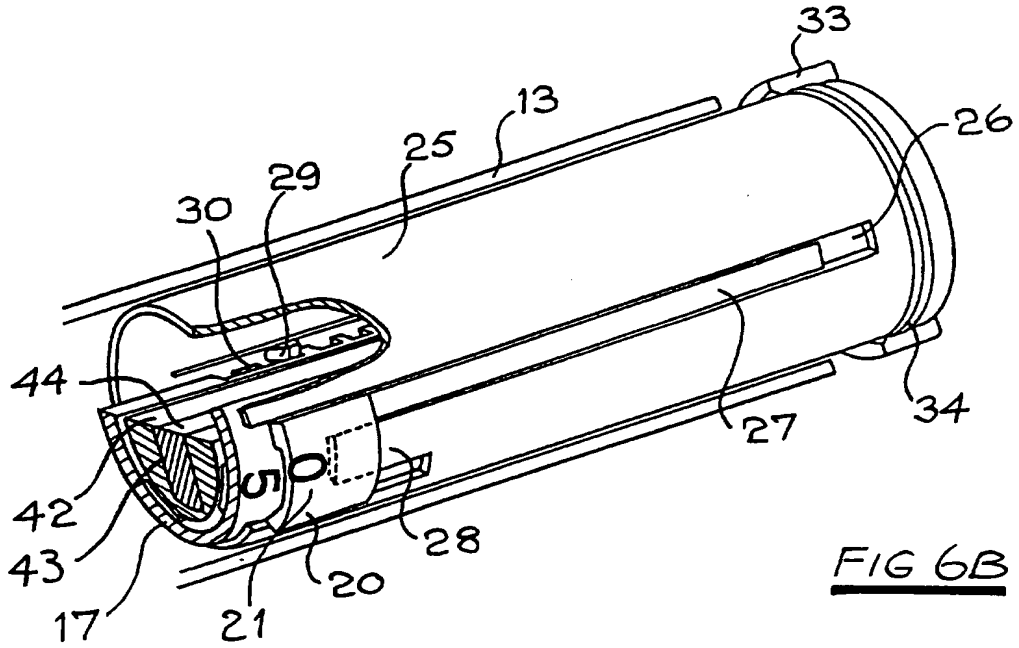
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FIG 6B

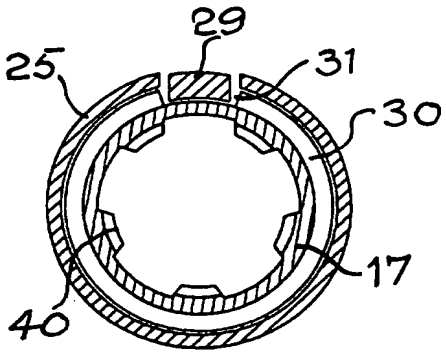

FIG 7A

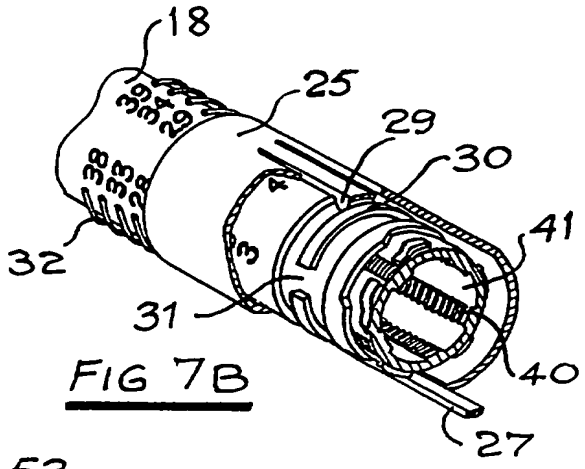

FIG 7B

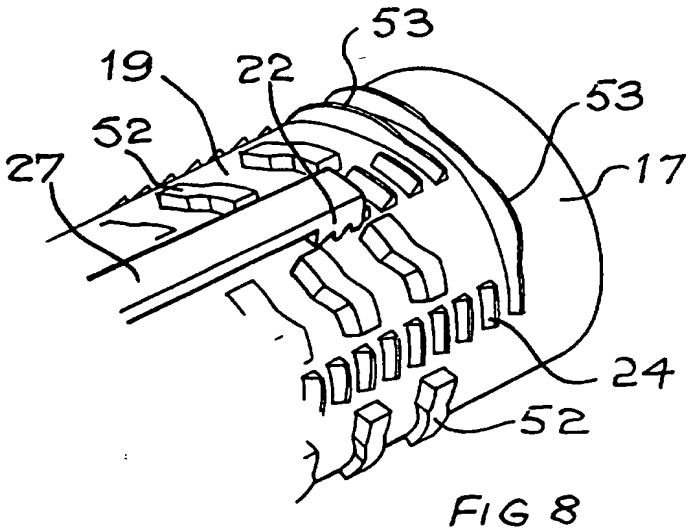

FIG 8

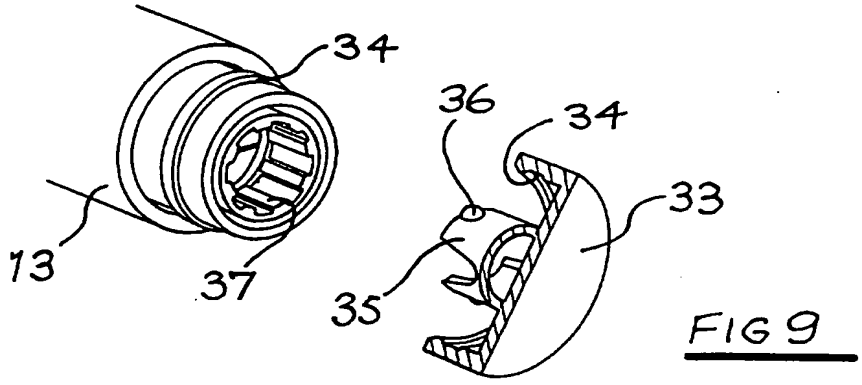

FIG 9

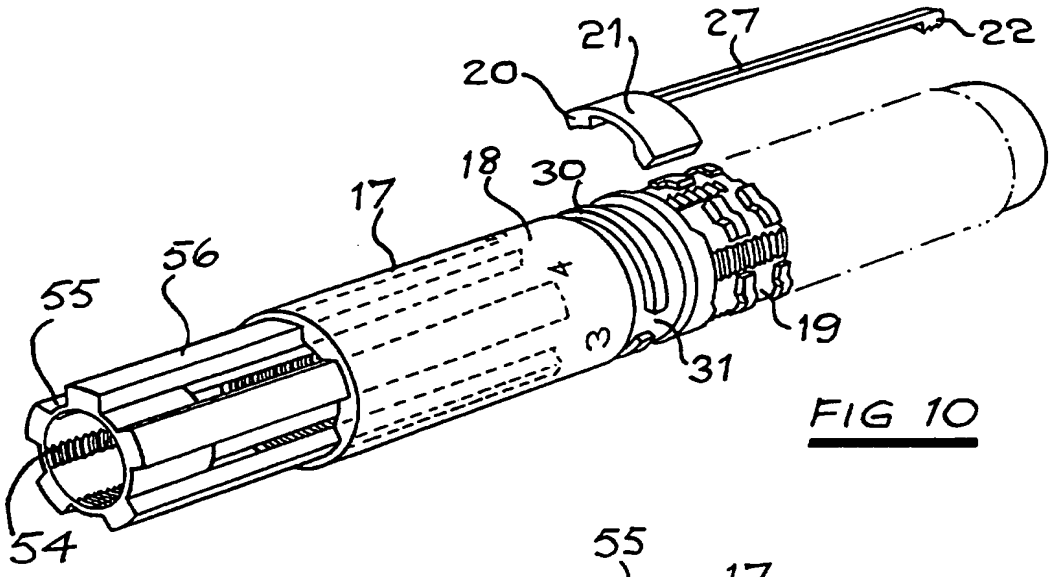

FIG 10

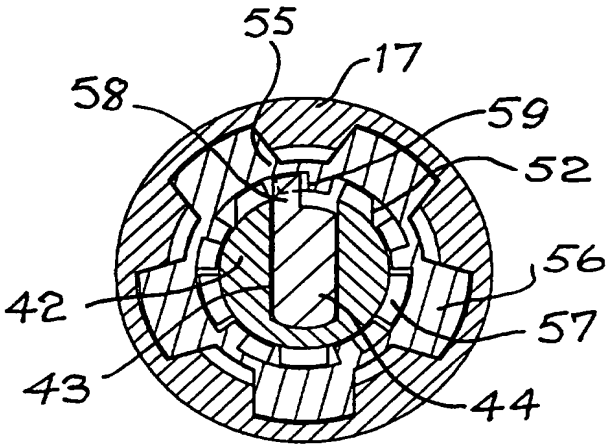

FIG 11

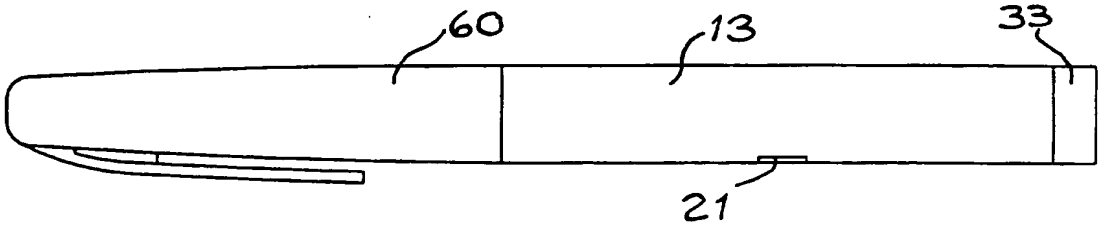

FIG 12